Institute Report No. 350

Acute Oral Toxicity of Ball Powder® in Sprague-Dawley Rats

Earl W. Morgan, DVM, MAJ, VC
Lance O. Lollini, DVM, LTC, VC
Conrad R. Wheeler, PhD
and
Don W. Korte, Jr., PhD, LTC, MSC

MAMMALIAN TOXICOLOGY BRANCH
DIVISION OF TOXICOLOGY

July 1989

Toxicology Series: 129

LETTERMAN ARMY INSTITUTE OF RESEARCH
PRESIDIO OF SAN FRANCISCO, CALIFORNIA 94129

This document has been approved for public release and sale; its distribution is unlimited.

Destroy this report when it is no longer needed. Do not return to the originator.

Citation of trade names in this report does not constitute an official endorsement or approval of the use of such items.

This research was conducted in compliance with the "Guide for the Care and Use of Laboratory Animals," NIH Publication No. 85-23, as prepared by the Institute of Laboratory Animal Resources, National Research Council.

This material has been reviewed by Letterman Army Institute of Research and there is no objection to its presentation and/or publication. The opinions or assertions contained herein are the private views of the author(s) and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense. *(AR 360-5)*

for Edwin S. Beatrice
COL, MC
Commanding

11 July 1989
(date)

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION: UNCLASSIFIED

1b. RESTRICTIVE MARKINGS:

2a. SECURITY CLASSIFICATION AUTHORITY:

3. DISTRIBUTION/AVAILABILITY OF REPORT: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.

2b. DECLASSIFICATION/DOWNGRADING SCHEDULE:

4. PERFORMING ORGANIZATION REPORT NUMBER(S): Institute Report No.: 350

5. MONITORING ORGANIZATION REPORT NUMBER(S):

6a. NAME OF PERFORMING ORGANIZATION: Mammalian Toxicology, Division of Toxicology

6b. OFFICE SYMBOL (If applicable): SGRD-ULE-T

7a. NAME OF MONITORING ORGANIZATION: US Army Biomedical Research and Development Laboratory

6c. ADDRESS (City, State, and ZIP Code): Letterman Army Institute of Research, Presidio of San Francisco, CA 94129-6800

7b. ADDRESS (City, State, and ZIP Code): Fort Detrick, Frederick, MD 21701-5010

8a. NAME OF FUNDING/SPONSORING ORGANIZATION: US Army Medical Research & Development Command

8b. OFFICE SYMBOL (If applicable):

9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER:

8c. ADDRESS (City, State, and ZIP Code): Fort Detrick, Frederick, Maryland 21701-5012

10. SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT ACCESSION NO.
62720	A835	AB	DA303913

11. TITLE (Include Security Classification): (U) Acute Oral Toxicity of Ball Powder® in Sprague-Dawley Rats

12. PERSONAL AUTHOR(S): EW Morgan, CR Wheeler, LO Lollini, and DW Korte, Jr.

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Institute	FROM 7MAR85 TO 29MAR85	July 1989	20

16. SUPPLEMENTARY NOTATION: Toxicology Series No. 129

17. COSATI CODES		
FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number): Acute Oral Toxicity, Ball Powder®, Rat, Nitrocellulose, Mammalian Toxicology, Propellant

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The acute oral toxicity of Ball Powder® was determined in male and female Sprague-Dawley rats by using the oral gavage single-dose method. The median lethal dose for both male and female Sprague-Dawley rats was greater than 5000 mg/kg. Clinical signs, red nasal discharge, irritability, increased respiratory rate, increased startle reflex, and inactivity, were minimal both in severity and duration. According to the classification scheme of Hodge and Sterner, these results place Ball Powder® in the practically nontoxic class.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT: ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS

21. ABSTRACT SECURITY CLASSIFICATION: UNCLASSIFIED

22a. NAME OF RESPONSIBLE INDIVIDUAL: EDWIN S. BEATRICE, COL, MC

22b. TELEPHONE (Include Area Code): (415) 561-3600

22c. OFFICE SYMBOL: SGRD-ULZ

DD Form 1473, JUN 86 — Previous editions are obsolete.

ABSTRACT

The acute oral toxicity of Ball Powder® was determined in male and female Sprague-Dawley rats by using the oral gavage single-dose method. The median lethal dose for both male and female Sprague-Dawley rats was greater than 5000 mg/kg. Clinical signs, red nasal discharge, irritability, increased respiratory rate, increased startle reflex, and inactivity, were minimal both in severity and duration. According to the classification scheme of Hodge and Sterner, these results place Ball Powder® in the practically nontoxic class.

Key Words: Acute Oral Toxicity, Nitrocellulose, Propellant, Ball Powder®, Mammalian Toxicology, Rat

PREFACE

TYPE REPORT: Acute Oral Toxicity GLP Study Report

TESTING FACILITY:

US Army Medical Research and Development Command
Letterman Army Institute of Research
Presidio of San Francisco, CA 94129-6800

SPONSOR:

US Army Medical Research and Development Command
US Army Biomedical Research and Development Laboratory
Fort Detrick, MD 21701-5010
Project Officer: Gunda Reddy, PhD

PROJECT/WORK UNIT/APC: 3E162720A835/180/TLB0

GLP STUDY NUMBER: 84034

STUDY DIRECTOR: LTC Don W. Korte, Jr., PhD, MSC
Diplomate, American Board of Toxicology

PRINCIPAL INVESTIGATOR: MAJ Earl W. Morgan, DVM, VC
Diplomate, American College of
Veterinary Preventive Medicine,
American Board of Toxicology

PATHOLOGIST: LTC Lance O. Lollini, DVM, VC, Diplomate
American College of Veterinary Pathologists

REPORT AND DATA MANAGEMENT: A copy of the final report, study protocol, SOPs, raw data, analytical, stability, and purity data of the test compound, and an aliquot of the test compound will be retained in the LAIR Archives.

TEST SUBSTANCE: Ball Powder®

INCLUSIVE STUDY DATES: 7 March - 29 March 1985

OBJECTIVE: The objective of this study was to determine the acute oral toxicity of Ball Powder® in male and female Sprague-Dawley rats.

ACKNOWLEDGMENTS

Gerald F.S. Hiatt, PhD, SP4 John R.G. Ryabik, BS, and SP4 James J. Fischer provided research assistance; SSG James D. Justus, BS, SP4 James J. Fischer, PFC Scott L. Schwebe, Richard A. Spieler, and Charlotte L. Speckman provided animal care; and Colleen S. Kamiyama, Brenda V. Goce, and Julie Peacock provided secretarial assistance.

SIGNATURES OF PRINCIPAL SCIENTISTS AND MANAGERS INVOLVED IN THE STUDY

We, the undersigned, declare that GLP Study 84034 was performed under our supervision, according to the procedures described herein, and that this report is an accurate record of the results obtained.

Don W. Korte 14FEB86
DON W. KORTE JR., PhD / DATE
MAJ, MS
Study Director

Lance O. Lollini 14 Feb 86
LANCE O. LOLLINI, DVM / DATE
LTC, VC
Pathologist

Earl W. Morgan 14 Jan 86
EARL W. MORGAN, DVM / DATE
CPT, VC
Principal Investigator

Conrad Wheeler 17 Jan 86
CONRAD R. WHEELER, PhD / DATE
DAC
Analytical Chemist

DEPARTMENT OF THE ARMY

LETTERMAN ARMY INSTITUTE OF RESEARCH
PRESIDIO OF SAN FRANCISCO, CALIFORNIA 94129-6800

REPLY TO
ATTENTION OF:

SGRD-ULZ-CA 5 July 1989

MEMORANDUM FOR RECORD

SUBJECT: GLP Compliance for GLP Study 84Ø34

1. This is to certify that the protocol for LAIR GLP Study 84Ø34 was reviewed on 1 November 1984.

2. The institute report entitled "Acute Oral Toxicity of Ballpowder in Rats," Toxicology Series 129, was audited on 29 March 1987.

Carolyn M. Lewis

CAROLYN M. LEWIS, MS
Diplomate, American Board of Toxicology
Quality Assurance Auditor

TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

Acute Oral Toxicity of Ball Powder® in Sprague-Dawley Rats--Morgan *et al.*

INTRODUCTION

Nitroguanidine, a primary component of US Army triple-base propellants, is now produced in a Government-owned contractor-operated ammunition plant. The US Army Biomedical Research and Development Laboratory (USABRDL), as part of its mission to evaluate the environmental and health hazards of military-unique propellants generated by US Army munitions manufacturing facilities, conducted a review of the nitroguanidine database and identified significant gaps in the toxicity data (1). The Division of Toxicology, Letterman Army Institute of Research (LAIR), was tasked by USABRDL to develop a genetic and mammalian toxicity profile for nitroguanidine, related intermediates/by-products of its manufacture, and its environmental degradation products. A genetic and acute mammalian toxicity profile of Ball Powder®, a fielded nitrocellulose-based propellant, was also requested as a baseline against which the triple-base propellant formulations will be compared.

Objective of Study

The objective of this study was to determine the acute oral toxicity of Ball Powder® in male and female albino Sprague-Dawley rats.

MATERIALS

Test Substance

Name: Ball Powder® (Olin WC 844 double base spheroid propellant)

LAIR Code Number: TA45

Chemical Composition:

Component	Percent
Nitroglycerin	10.235
Dinitrotoluene	0.685
Diphenylamine	1.105
Dibutylphthalate	5.255
Nitrocellulose	83.23
Total Volatiles	1.045
Moisture and Volatiles	0.895
Residual Solvent	0.49
Calcium Carbonate	0.09
Sodium Sulfate	0.12

Source: Badger Army Ammunition Plant
Baraboo, WI 53913

Other test substance information is presented in Appendix A.

Vehicle

The vehicle for Ball Powder® was 1% carboxymethylcellulose (Sigma Chemical Co., St. Louis, MO), expiration date 1 July 1991, in sterile water for injection (Abbott Laboratories, North Chicago, IL).

Animal Data

Twelve male and 12 female Sprague-Dawley rats (Bantin & Kingman, Fremont, CA) from a shipment that arrived on 7 Mar 85 were used for this study. They were identified individually with ear tags numbered 85D00141 to 85D00152 (males) and 85D00288 to 85D00299 (females) inclusive. Two males (85D00158, 85D00212) and 2 females (85D00223, 85D00240) were selected randomly from the shipment for quality control necropsy evaluation at receipt. The animal weights on receipt ranged from 134 to 160 g. Additional animal data appear in Appendix B.

Husbandry

Rats were caged individually in stainless-steel wire-mesh cages in racks equipped with automatically flushing dump

tanks. No bedding was used in any of the cages. The diet, fed *ad libitum*, consisted of Certified Purina Rodent Chow® Diet 5002 (Ralston Purina Company, Checkerboard Square, St. Louis, MO); water was provided by continuous drip from a central line. The animal room temperature was maintained in a range from 24.4°C to 25.5°C with a relative humidity range of 26% to 42% with temporary spikes to 53% during room washing. The photoperiod was 12 hours of light per day.

METHODS

Group Assignment/Acclimation

Study rats were assigned to a dose group of 7 males and 7 females and a vehicle control group of 5 males and 5 females each. The animals were acclimated for 7 days before the day of dosing. During this period they were observed daily for signs of illness.

Dose Levels

Since the median lethal dose (MLD) of the major component of Ball Powder®, nitrocellulose, is greater than 5000 mg/kg (2), a "limit dose" of 5000 mg/kg was selected for evaluating the acute oral toxicity of Ball Powder®.

Compound Preparation

Ball Powder® was ground in a mortar and pestle under liquid nitrogen, sieved through a 80-mesh screen, and then suspended in the vehicle with a spatula. The carboxymethylcellulose (CMC) vehicle had been prepared by mixing 1 g of CMC in 100 ml of sterile water using a Kinematica model CH-6010 homogenizer.

Chemical Analysis of Dosing Suspension

Since Ball Powder® is a complex mixture, analysis of the dosing solution for accuracy and stability was not technically feasible. To ensure the accuracy of the administered dose, the dosing suspension was prepared immediately before dosing. The dosing procedure was completed within 30 minutes.

Test Procedures

This study was conducted in accordance with EPA guidelines (3) and LAIR SOP-OP-STX-36 (4).

The volume of dosing suspension each animal received was based upon the desired dose level, the concentration of the compound in the suspension, and the weight of the animal. Volumes ranged from 1.7 to 1.9 ml in the males and from 1.5 to 1.6 ml in the females. The vehicle control group was given 1.4 to 1.8 ml (10 ml/kg) of the 1% carboxymethylcellulose suspension. Dosing was performed using the oral gavage method without sedating the animals or administering anesthesia. Sterile disposable syringes (Becton, Dickenson & Co, Rutherford, NJ) fitted with 16 gauge, 3-inch, ball-tipped feeding tubes (Popper & Sons, Inc., New Hyde Park, NY) were used for dosing. The test compound animals were dosed between 0929 and 0957 hours on 14 March 1985. The vehicle control animals were dosed between 0801 and 0823 hours on 15 March 1985.

Observations

Observations for mortality and signs of acute toxicity were performed daily according to the following procedure: (a) animals were observed undisturbed in their cages, (b) animals were removed from their cages and given a physical examination, and (c) animals were observed after being returned to their cages. On the day of dosing, the animals were checked intermittently throughout the day. Recorded observations were performed 1, 2, and 4 hours after dosing and daily for the remainder of the 2-week test period. A second "walk-through" observation was performed daily and only significant observations recorded. Body weights were recorded weekly during the course of the study.

Necropsy

All animals were submitted for a complete gross necropsy immediately after receiving a barbiturate overdose.

Duration of Study

Appendix C is a complete historical listing of study events.

Changes/Deviations

The study was accomplished according to the protocol and applicable amendments with the following exceptions: The

vehicle control group was dosed on 15 March 1985, since they had not been fasted for dosing on 14 March 1985; the vehicle control group necropsy date was correspondingly delayed one day to 29 March 1985. The vehicle control group was fasted only five hours before necropsy versus 16 hours for the dosed group. This would account for control group's apparent weight gain as compared to the dosed animals. The water lixits for two females (85D00290, 85D00295) in the vehicle control group did not function properly the night before dosing. No chemical analysis of the test compound/dosing suspension was performed because of the chemical complexity of Ball Powder®. None of these changes was thought to have an effect on the study.

Storage of Raw Data and Final Report

A copy of the final report, study protocols, raw data, retired SOPs and an aliquot of the test compound will be retained in the LAIR Archives.

RESULTS

Mortality

No deaths occurred in either the test compound or the vehicle control groups.

Clinical Observations

The most frequently observed categories of clinical signs in animals administered the limit dose of Ball Powder® were behavioral disturbances (4 of 14 animals dosed), and a reddish discharge on the nose (4 of 14). Behavioral signs included irritability and inactivity. Signs were observed within 2 hours of dosing and had resolved by 72 hours. All animals survived until termination of the study.

Table 1 contains a summary of clinical observations. Appendix D contains individual animal histories.

Weight gains of survivors were not affected by dosing. Table 2 presents the mean body weights by groups. Appendix E contains individual weight tables.

Gross Pathology Findings

No lesions were found at necropsy that could be attributed to the test compound or the dosing procedure. The veterinary pathologist's report appears in Appendix F.

TABLE 1: Incidence Summary for Clinical Observations in Rats Administered Ball Powder® (Limit Dose)

Category Clinical Signs	Group Dose (mg/kg) (N=)	1 Vehicle 5	2 5000 (limit) 7
MALES			
Respiratory[a]		0	1
Behavorial[b]		0	3
Hair[c]		1	0
Hunched Posture		0	1
General[d]		1	0
Miscellaneous[e]		1	3
Normal		3	3
FEMALES			
Behavorial[b]		1	1
Hair[c]		1	0
Hunched Posture		0	1
General[d]		2	0
Miscellaneous[e]		0	1
Reflex[f]		0	1
Normal		2	5

[a]Includes increases in rate.
[b]Includes irritability, inactivity, and hyperactivity.
[c]Includes alopecia.
[d]Includes infection of the ear (male) or dehydration (females).
[e]Includes reddish discharge from the nose.
[f]Includes changes in the startle reflex.

TABLE 2: Mean Body Weights for Rats Administered Ball Powder®

Group	Receipt	Dosing Day	Day 7*	Day 14†
		MALES		
5000 mg/kg	143.4 ±2.1(7)	175.4 ±3.5(7)	251.7 ±5.5(7)	269.1 ±6.5(7)
Vehicle Control	140.2 ±3.0(5)	171.0 ±4.0(5)	242.2 ±3.6(5)	290.4 ±4.0(5)
		FEMALES		
5000 mg/kg	153.1 ±1.6(7)	156.6 ±1.2(7)	198.6 ±1.2(7)	203.7 ±2.5(7)
Vehicle Control	144.6 ±2.0(5)	144.8 ±3.1(5)	185.4 ±4.6(5)	203.2 ±7.9(5)

*Day 6 for vehicle controls.

†The compound dosed groups were fasted 16 hours. The vehicle control groups were fasted 5 hours.

DISCUSSION

The median lethal dose (MLD) for Ball Powder® is greater than 5000 mg/kg in male and female Sprague-Dawley rats. This places ballpowder in the "practically nontoxic" class (5). Clinical signs observed following Ball Powder® administration included behavioral signs (inactivity, irritability) and a reddish discharge from the nose. These signs are non-specific and could not be attributed to an effect on a specific organ system. The lack of a toxic response to Ball Powder® was surprising because even though Ball Powder® contains 83% nitrocellulose by weight, which is essentially nontoxic (2), it does contain 10.2% nitroglycerin. Nitroglycerin has appreciable toxicity--an oral MLD in rats of 525 mg/kg (6). Since the calculated amount of nitroglycerin administered as Ball Powder® to the animals in this study was 510 mg/kg, one would expect the animals to exhibit appreciable nitroglycerin-related toxicity. The fact that this was not observed suggests that the nitroglycerin is complexed in the Ball Powder® formulation in such a way that it is no longer toxic.

CONCLUSION

Ball Powder® is a practically nontoxic compound since it produced no significant observable effects or deaths at the "limit dose" of 5000 mg/kg in male and female Sprague-Dawley rats.

REFERENCES

1. Kenyon KF. A data base assessment of environmental fate aspects of nitroguanidine. Frederick, MD: US Army Medical Bioengineering Research and Development Laboratory, 1982; DTIC No. ADA125591.

2. Lee CC, Dilley JY, Hodgson JR, et al. Mammalian toxicity of munition compounds: Phase 1. Acute oral toxicity, primary skin and eye irritation, dermal sensitization and disposition and metabolism. Report No. 1. Kansas City, MO: Midwest Research Institute, 1975; Contract No. DAMD-17-74-C-4073. MRI Project No. 3900-B.

3. Environmental Protection Agency. Office of Pesticides and Toxic Substances, Office of Toxic Substances (TS-792). Acute exposure, oral toxicity. In: Health effects test guidelines. Washington, DC: Environmental Protection Agency, August 1982; EPA 560/6-82-0011.

4. Acute oral toxicity study (ALD and LD_{50}). LAIR Standard Operating Procedure OP-STX-36, Presidio of San Francisco, CA. Letterman Army Institute of Research, 15 June 1984.

5. Hodge HC, Sterner JH. Tabulation of toxicity classes. Amer Ind Hyg Assoc Q. 1943; 10:93-96.

6. Dreishach RH, ed. Handbook of poisoning: Diagnosis and treatment. Los Altos, CA: Lange Medical Publications 1974:338.

Appendix A: CHEMICAL DATA

PROPELLANT DESCRIPTION SHEET

REPORTS CONTROL SYMBOL
EXEMPT - PARA 7-2a
AR 335-15

TO	FROM	DATE
	Badger Army Ammunition Plant Baraboo, Wisconsin 53913	10 August 1984

DA LOT NUMBER 50/50 blend of lots BAJ-47670 and BAJ-47671	COMPOSITION NUMBER WC 844 for Cartridge 5.56 mm, BALL, M193
MFG AT Badger Army Ammunition Plant	PACKED AMOUNT LB
CONTRACT NUMBER DAAA09-73-C-0004	SPECIFICATION NUMBER MIL-P-3984E w/Amendment 4 and Drawing No. C10542743 Rev. C

NITROCELLULOSE

ACCEPTED BLEND NUMBERS	NITROGEN CONTENT	KI STARCH(65.5°C)	STABILITY (134.5°C)
Nitrocellulose (NC) extracted from excessed	MAX %	MIN	MIN
Single Base Propellant.	MIN %	MIN	MIN
	AVG %	MIN	MIN
NC complied with MIL-N-244A			EXPLOSION HR

MANUFACTURE OF PROPELLANT

_____POUNDS SOLVENT PER POUND NC/DRY WEIGHT INGREDIENTS CONSISTING OF _____ POUNDS ALCOHOL AND _____ POUNDS _____ PER 100 POUNDS SOLVENT. PERCENTAGE REMIX TO WHOLE _____.

TEMPERATURE FROM	TEMPERATURE TO	PROCESS-SOLVENT RECOVERY AND DRYING	TIME DAYS	TIME HOURS

PROPELLANT COMPOSITION / TESTS OF FINISHED PROPELLANT / STABILITY AND PHYSICAL TESTS

CONSTITUENT	% FORMULA	% TOLERANCE	% MEASURED		FORMULA	ACTUAL
Nitroglycerin			10.235	HEAT TEST 120°	Min 60 min.	65 min.*
Dinitrotoluene			0.685	No Explosion (HRS)	Min 5	5+*
Diphenylamine			1.105	FORM OF PROPELLANT		
Dibutylphthalate			5.255	Dust&Foreign Mat.		0.02
Nitrocellulose			83.23	Graphite		0.075
Total Volatiles			1.045	Grav. Density		1.008
Moisture and Volatiles			0.895	Nitrogen		13.075
Residual Solvent			0.49			
Calcium Carbonate			0.09			
Sodium Sulfate			0.12			

CLOSED BOMB	LOT NUMBER	TEMP °F	RELATIVE QUICKNESS	RELATIVE FORCE
TEST				
STANDARD			100.00%	100.00%

PROPELLANT DIMENSIONS (INCHES)	SPEC	DIE	FINISHED	MEAN VARIATION IN % OF MEAN DIMENSIONS SPEC	MEAN VARIATION IN % OF MEAN DIMENSIONS ACTUAL
LENGTH (L)					
DIAMETER (D)					
PERF DIA (d)					
				PACKED	
				SAMPLED	
WEB DIFFERENCE /STD DEV IN % OF WEB AVERAGE				TEST FINISHED	
				OFFERED	
L:D				DESCRIPTION SHEETS FORWARDED	
D:d					

REMARKS

TYPE OF PACKING CONTAINER

REMARKS
*Tested 29 February 1984.

SIGNATURE OF CONTRACTOR'S REPRESENTATIVE	SIGNATURE OF GOVERNMENT QUALITY ASSURANCE REPRESENTATIVE

Appendix B: ANIMAL DATA

Species: *Rattus norvegicus*

Strain: Sprague-Dawley

Source: Bantin & Kingman Fremont, CA

Sex: Male and female.

Dates of birth: Male: 28 January 1985
Female: 23 January 1985

Animals in each group: Test: 7 males and 7 females
Control: 5 males and 5 females

Condition of animals at start of study: Normal

Body weight range at dosing: 143-191 g

Identification procedures: Ear tagging procedure (SOP OP-ARG-1), tag numbers between 85D00141 to 85D00152 and 85D00288 to 85D00299, 85D00158, 85D00212, 85D00223, and 85D00240 inclusive.

Pretest conditioning: Quarantine/acclimation 7 March - 14 March 1985

Justification: The laboratory rat has proven to be a sensitive and reliable system for lethal dose determination.

Appendix C: HISTORICAL LISTING OF STUDY EVENTS

Date	Event
7 Mar 85	Received 80 male and 79 female Sprague-Dawley rats. Rats were checked for physical condition, sexed, and individually caged. Males were weighed and ear-tagged.
8 Mar 85	Females were weighed and ear-tagged.
8-13 Mar 85	Animals were observed daily.
13 Mar 85	Rats were weighed and four (2 male and 2 female) were submitted for necropsy quality control. Food was removed from the 14 test animals.
14 Mar 85	Test compound animals were weighed, dosed, and observed at 1, 2, and 4 hours after dosing. Food was removed from the vehicle control animals.
15 Mar 85	Vehicle control animals were weighed, dosed, and observed at 1, 2, and 4 hours after dosing.
15-29 Mar 85	All animals were observed daily in a.m. and p.m.
21 Mar 85	All animals weighed.
25 Mar 85	Transferred 120 animals to GLP Study #84011 and 11 animals to Non-GLP Study #74025.
28 Mar 85	Test compound animals were weighed, sacrificed, and submitted for necropsy.
29 Mar 85	Vehicle control animals were weighed, sacrificed, and submitted for necropsy.

Appendix D: INDIVIDUAL ANIMAL HISTORIES

5000 mg/kg Ball Powder®

Animal Number	Clinical Signs	Dates Observed (1985)	Severity
	MALES		
84D00141	Irritable	Mar. 14,16	Slight
	Incr. Respiration Rate	Mar. 14	Slight
84D00142	Normal	N/A	N/A
84D00143	Discharge, Nose, Red	Mar. 14	Slight
84D00144	Hunched Posture	Mar. 14	Slight
	Inactive	Mar. 14,15	Slight
	Discharge, Nose, Red	Mar. 14	Slight
84D00145	Normal	N/A	N/A
84D00147	Discharge, Nose, Red	Mar. 14	Slight
	Inactive	Mar. 15	Slight
84D00148	Normal	N/A	N/A
	FEMALES		
84D00292	Normal	N/A	N/A
84D00293	Normal	N/A	N/A
84D00294	Normal	N/A	N/A
84D00296	Normal	N/A	N/A
84D00297	Normal	N/A	N/A
84D00298	Irritable	Mar. 14	Slight
	Discharge, Nose, Red	Mar. 14	Slight
	Hunched Posture	Mar. 14	Slight
84D00299	Incr. Startle Reflex	Mar. 14	Slight

Appendix D (cont.): INDIVIDUAL ANIMAL HISTORIES

Vehicle Control

Animal Number	Clinical Signs	Dates Observed (1984)	Severity
	MALES		
84D00146	Infection, Right Ear	Mar. 16	Slight
84D00149	Normal	N/A	N/A
84D00150	Normal	N/A	N/A
84D00151	Normal	N/A	N/A
84D00152	Alopecia, Right Ribs	Mar. 15-29	Present
	Discharge, Nose, Red	Mar. 15	Slight
	FEMALES		
84D00288	Alopecia, Abdomen	Mar. 15-29	Present
	Hyperactive	Mar. 15,16	Slight
84D00289	Normal	N/A	N/A
84D00290	Dehydration	Mar. 15	Present
84D00291	Normal	N/A	N/A
84D00295	Dehydration	Mar. 15	Present

Appendix E: INDIVIDUAL BODY WEIGHTS (grams)

5000 mg/kg

Animal Number	At Receipt (g)	At Dosing (g)	Day 7 (g)	Termination Day 14 (g)
		MALES		
85D00141	138	167	244	260
85D00142	140	175	257	273
85D00143	139	167	246	262
85D00144	149	178	253	270
85D00145	148	183	264	286
85D00147	151	191	271	292
85D00148	139	167	227	241
Mean	143.4	175.4	251.7	269.1
Standard Deviation	5.6	9.3	14.5	17.1
Standard Error of the Mean	2.1	3.5	5.5	6.5
		FEMALES		
85D00292	156	156	199	205
85D00293	150	159	204	213
85D00294	156	161	205	209
85D00296	149	155	203	201
85D00297	152	151	190	199
85D00298	149	157	200	206
85D00299	160	157	189	193
Mean	153.1	156.6	198.6	203.7
Standard Deviation	4.3	3.2	6.6	6.7
Standard Error of the Mean	1.6	1.2	2.5	2.5

Appendix E (cont.): INDIVIDUAL BODY WEIGHTS (grams)

Vehicle Control

Animal Number	At Receipt (g)	At Dosing (g)	Day 7 (g)	Termination Day 14 (g)
		MALES		
85D00146	144	169	237	285
85D00149	135	156	231	278
85D00150	150	178	251	295
85D00151	138	176	247	301
85D00152	134	176	245	293
Mean	140.2	171.0	242.2	290.4
Standard Deviation	6.7	9.1	8.1	9.0
Standard Error of the Mean	3.0	4.0	3.6	4.0
		FEMALES		
85D00288	149	155	202	228
85D00289	149	147	184	183
85D00290	140	143	181	204
85D00291	145	143	174	190
85D00295	140	136	186	211
Mean	144.6	144.8	185.4	203.2
Standard Deviation	4.5	6.9	10.3	17.7
Standard Error of the Mean	2.0	3.1	4.6	7.9

Appendix F: PATHOLOGY REPORT

LAIR Gross Pathology Report
GLP Study 84034

Study: GLP #84034, Toxicology Services Group

Test: Oral LD_{50} (Limit Test) Ballpowder.

Investigator: CPT Morgan

Test Substance: Ballpowder (Olin WC844 double-based spheroidal propellant).

History: Twelve male Sprage-Dawley rats were divided into 2 groups of five and seven. Five were given dose vehicle and 7 were given 5000 mg of Ballpowder/kg BW by oral gavage.

Twelve female Sprague-Dawley rats were divided into 2 groups of five and seven. Five were give dose vehicle and seven were given 5000 mg of Ballpowder/kg BW by oral gavage.

The study was conducted in accordance with SOP-OP-STX-36 (15 June 84). The dose vehicle was carboxmethylcellulose (sodium salt). There were no spontaneous deaths during the study.

Necropsy findings: The individual animal necropsy findings are summarized below:

Findings:

MALE - VEHICLE CONTROL

LAIR ACC#	ID#	GROSS FINDINGS
37123	85D00146	Not Remarkable (NR) Ear tag missing
37124	85D00149	NR Ear tag missing
37125	85D00150	NR Ear tag missing
37126	85D00151	NR
37127	85D00152	NR

MALE - 5000 mg/kg

LAIR ACC#	ID#	GROSS FINDINGS
37103	85D00141	NR Ear tag missing
37104	85D00142	Right kidney - Hydronephosis, mild
37105	85D00143	NR Ear tag missing
37106	85D00144	NR Ear tag missing
37107	85D00145	Right kidney - Hydronephosis, moderate
37108	85D00147	NR
37109	85D00148	NR

Appendix F (cont.): PATHOLOGY REPORT

Pathology Report
GLP Study 84034

FEMALE - VEHICLE CONTROL

LAIR ACC#	ID#	GROSS FINDINGS
37128	85D00288	NR
37129	85D00289	NR Ear tag missing
37130	85D00290	Right kidney - Hydronephosis, moderate
37131	85D00291	NR
37132	85D00295	NR

FEMALE - 5000 mg/kg

LAIR ACC#	ID#	GROSS FINDINGS
37110	85D00292	NR
37111	85D00293	NR
37112	85D00294	NR Ear tag missing
37113	85D00296	NR Ear tag missing
37114	85D00297	NR Ear tag missing
37115	85D00298	NR
37116	85D00299	NR

All gross findings are interpreted as unrelated to the treatment.

Summary: Ballpowder given orally at 5000 mg/kg BW to male and female Sprage-Dawley rats is not lethal and did not result in grossly evident lesions over a two week period.

ROBERT L. MORRISSEY, DVM
LTC, VC
USAR

LANCE O. LOLLINI, DVM
LTC, VC
Chief, Pathology Services Group

30 July 1985

Distribution List

Commander
US Army Biomedical Research and Development Laboratory (15)
ATTN: SGRD-UBZ-C
Fort Detrick, Frederick, MD 21701-5010

Defense Technical Information Center (DTIC) (2)
ATTN: DTIC-DLA
Cameron Station
Alexandria, VA 22304-6145

US Army Medical Research and Development Command (2)
ATTN: SGRD-RMI-S
Fort Detrick, Frederick, MD 21701-5012

Commandant
Academy of Health Sciences, US Army
ATTN: AHS-CDM
Fort Sam Houston, TX 78234

Chief
USAEHA Regional Division, West
Fitzsimmons AMC
Aurora, CO 80045

Chief
USAEHA Regional Division, North
Fort George G. Meade, MD 20755

Chief
USAEHA Regional Division, South
Bldg. 180
Fort McPherson, GA 30330

Commander
USA Health Services Command
ATTN: HSPA-P
Fort Sam Houston, TX 78234

Commander US Army Materiel Command
ATTN: AMSCG
5001 Eisenhower Avenue
Alexandria, VA 22333

Commander
US Army Environmental Hygiene Agency
ATTN: Librarian, HSDH-AD-L
Aberdeen Proving Ground, MD 21010

Dean
School of Medicine
Uniformed Services University of the Health Sciences
4301 Jones Bridge Road
Bethesda, MD 20014

Commander
US Army Materiel Command
ATTN: AMCEN-A
5001 Eisenhower Avenue
Alexandria, VA 22333

HQDA
ATTN: DASG-PSP-E
Falls Church, VA 22041-3258

HQDA
ATTN: DAEN-RDM
20 Massachusetts, NW
Washington, D.C. 20314

CDR, US Army Toxic and Hazardous Material Agency
ATTN: DRXTH/ES
Aberdeen Proving Ground, MD 21010

Commandant
Academy of Health Sciences
United States Army
ATTN: Chief, Environmental Quality Branch
Preventive Medicine Division (HSHA-IPM)
Fort Sam Houston, TX 78234